



SOAR – A Virtual Manufacturing & Process Simulation Technology

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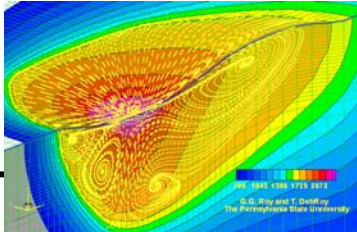
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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.



Some differences between SOAR and FEA computer models.

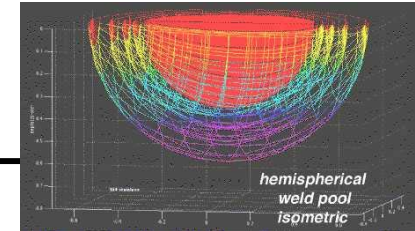


FEA Advantages

- Residual stress and distortion can be analyzed.
- Convective flow in weld pool can be simulated.

FEA Disadvantages

- Mesh generation and problem statement is time consuming and requires an expert analyst.
- Model complexity requires accurate knowledge of many material properties and boundary conditions.
- Limited materials list.



SOAR Advantages

- User friendly software is understandable to most process engineers.
- Fast desktop answers to common weld questions for many materials.
- Quick processing time enables multiple computations, alternate materials, joints, and conditions to be investigated.

SOAR Disadvantages

- Parts with complex geometries must be approximated with symmetrical shapes.
- Fluid flow is ignored with conduction only model.
- Stress and strain fields cannot be analyzed.

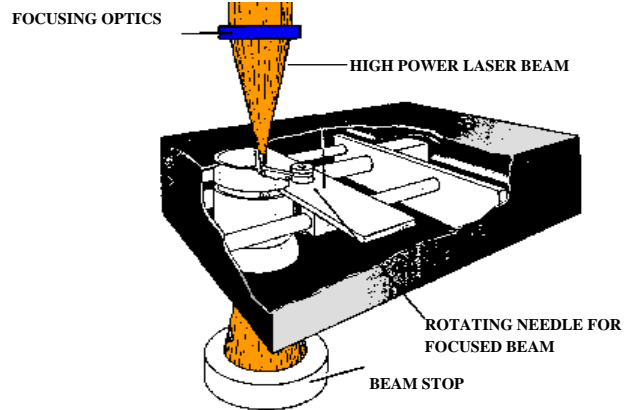
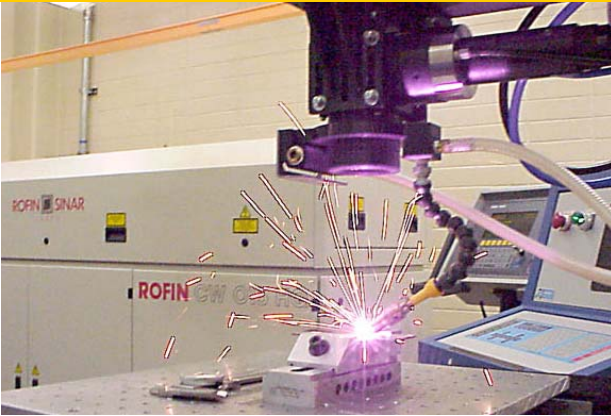


What SOAR can and cannot do.

- SOAR is a tool for designers and engineers to aid them in selecting, optimizing, and configuring a welding process.
- SOAR does not solve welding problems, it doesn't eliminate defects, or bridge joint gaps by itself.
- SOAR won't tell you if the temperature is too high at a specific location, but it will tell you the temperature.
- It won't tell you what pulse duration is best, but it will tell you what pulse durations give you the weld size you need.
- SOAR gives the user the information they need to understand and set-up a better process.

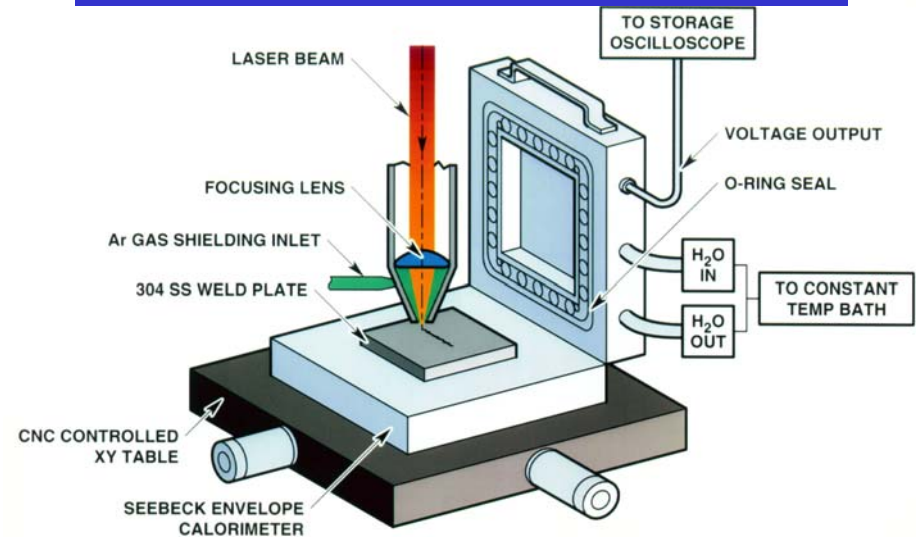
SNL Diagnostic Tools for Laser Beam Welding Research

Fiber delivered CW Nd:YAG laser

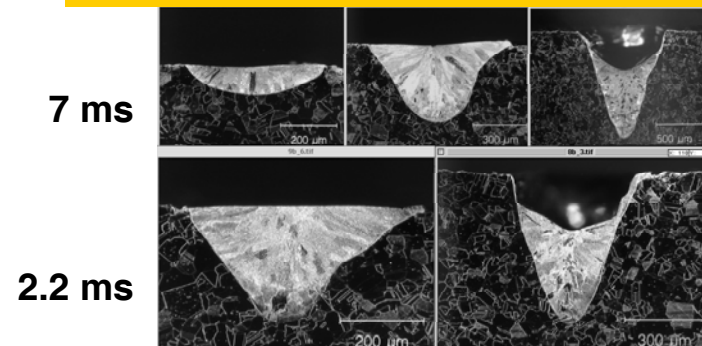


Spotsize measurements at the focal plane

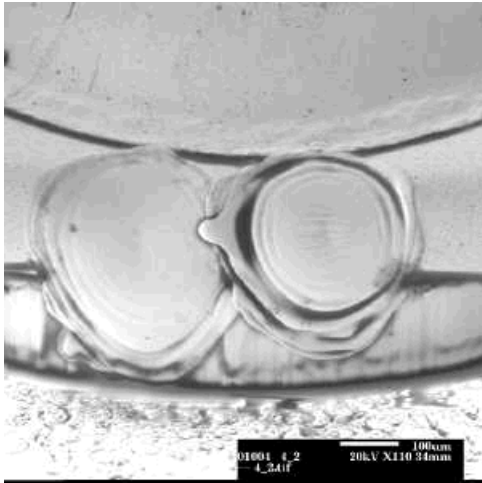
Heat input with Seebeck calorimeter



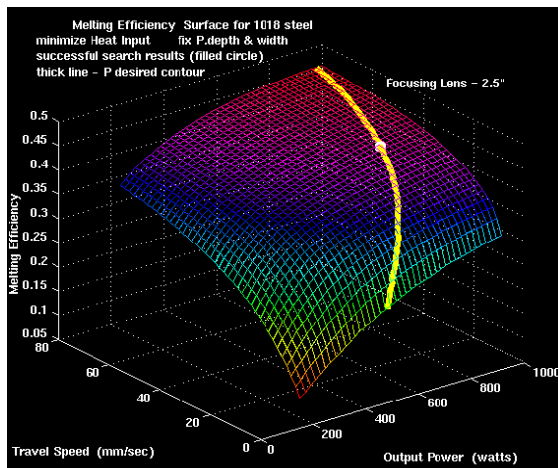
Laser weld fusion zone evolution



Weld Procedure Optimization. *Why?*

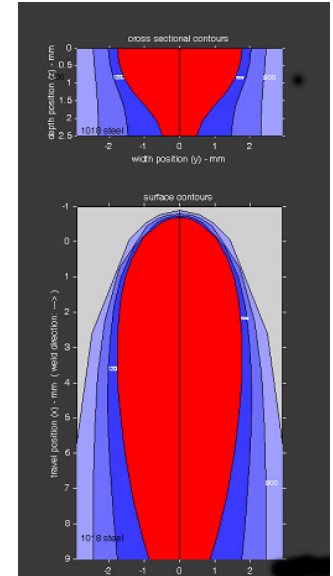


- Weld parameters should be specific to the application requirements.
- Weld procedure development should be science based, not based on skill and intuition.
- Virtual manufacturing enables the user to ask "what if?" and quickly find the answer.
- With SOAR, welds do not need to be made in order to determine weld effects and required parameters.



Barriers to more widespread adoption of SOAR in NNSA and industry

1. Traditional methods of weld procedure development are considered satisfactory.
2. Weld analysis software requires an inquisitive and knowledgeable user.
3. Sandia/DOE licensing process is inconvenient.
4. Many weld problems cannot be solved with current versions of SOAR.
5. Marketing and development resources for SOAR are very limited.



SOAR 2.5D
temperature fields

Free licenses at:

<http://www.sandia.gov/soar/>